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RELATIONSHIPS BETWEEN DOMAINS OF PROGRESS

INTRODUCTION

The idea that there are interactions between society, economy and the environment (the three broad domains of progress presented in **Measures of Australia's Progress**) has been around for some time. A change in one aspect of life is almost always associated with changes in others. Any assessment of whether life in Australia is improving will depend on the priority assigned to each domain of progress and will also be influenced by consideration of the many possible links between domains. Some of these links are well understood, while others are more complex and less obvious. The increasing focus on the need to measure all aspects of progress, not just economic, has made it important also to articulate relationships between the three broad domains: the economy, society and the environment.

While we consider the three domains separately in order to provide a way to organise the indicators presented in **Measures of Australia's Progress** (MAP), in reality the environment, economy and society cannot be separated. The three domains used in choosing the measures comprise one system. Although some concerns can, for the convenience of discussion, be attached loosely to the economy, the society or the environment, they are all of importance to other domains - education and training, and work, for example, are of both social and economic importance; air quality is of economic, social and environmental importance.

Drawing on MAP headline indicators and other information, this article provides an overview of some of the key relationships between the three domains. As the intent is to be illustrative, the article does not attempt to cover all relationships that exist, or bring together all the data which may be relevant to exploring these relationships. Many of the examples included in the article are very simple and well-known relationships.
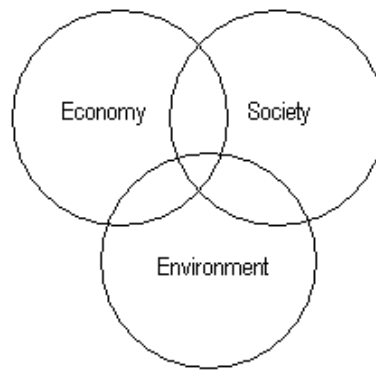
When considering indicators of progress, the question of sustainability is often raised. There are two different notions of sustainability: 'weak' and 'strong' sustainability. Weak sustainability only requires the total stock of economic, human, social and natural capital to be maintained. Therefore, forms of capital can be traded off against each other. It allows for the depletion or degradation of natural resources, as long as such depletion is offset by increases in the stocks of other forms of capital. Strong sustainability requires the levels of all types of capital - economic, human, social and natural – to be kept above a certain level (see endnote 1).

MAP was developed to help people determine whether or not life in Australia is improving. MAP does not make forecasts or enter into any direct discussions of sustainability, however this concept remains an underlying consideration when reporting on progress and as such is a recurring theme throughout this article.

A FRAMEWORK FOR RELATIONSHIPS BETWEEN THE DOMAINS OF PROGRESS

The framework below illustrates the inter-relationships between society, the economy and the environment, showing that the three domains comprise one system. The relationships between these domains flow in both directions, and some relationships flow between all three domains. For example, people may highly value preservation of the natural environment. The environmental concerns of consumers affect the economy and society. The way the economy responds to this consumer demand in turn affects the environment. While there are many examples of relationships flowing between all three broad domains of progress, this article focuses separately on relationships between the economy and the environment, the economy and society, and the environment and society.

Framework: inter-relationships between society, economy and environment

There are two broad types of relationships between the domains of progress: trade-offs and reinforcements. Trade-offs occur when one domain of progress improves at the expense of another, either as a result of a deliberate choice or as an unforeseen consequence. As economic activity rises so might greenhouse gas emissions. Reinforcements occur when one aspect of progress improves and strengthens another. For example, as economic production rises, employment may rise too.

As well as the interactions between the domains of progress, there are also relationships within domains. Within the environment domain, for example, clearing native forest may adversely affect biodiversity by removing the food and habitat on which some native species rely and will also impact on net greenhouse gas emissions through the removal of forest sinks. While these relationships are important for an assessment of progress, the focus of this article is on relationships between domains of progress, rather than within them.

RELATIONSHIPS BETWEEN SOCIETY AND THE ECONOMY

A healthy economy is often considered to be a key element of a healthy society. As production and incomes in the economy rise, material living standards may improve, reinforcing the social domain. This reinforcement may in turn lead to a further strengthening of the economy, when a healthier and more educated population contributes to increased productivity. The interaction of a number of factors contributes to economic growth, including rising population, increasing inputs such as labour (hours worked and number of people working) and capital, labour productivity growth and technological progress. Not all of the relationships are positive - a strong economy can lead to some trade-offs. Some of the key interactions between society and the economy are described below.

People generate demand

People generate demand for goods and services. Changes in demand can affect economic activity across industries over time, benefiting those industries which produce goods or services for which there is high demand and potentially leading to a change in the skill mix of labour required.

One of the indicators used to expand upon the national income dimension of MAP is real household final consumption per person. This indicator provides a household sector perspective of economic activity. Household final consumption is the 'using up' of goods and services, by people and non-profit institutions serving households, to satisfy needs and wants. It excludes intermediate consumption expenditure (the use of goods and services in the production of other goods and services) and expenditure on fixed assets such as dwellings.

Real household final consumption per person grew by 2.7% per year on average between 1996-97 and 2006-07. Household expenditure on communication showed particularly strong growth (an average increase of 6.8% per year, per person, after adjusting for inflation). Spending on goods for recreation and culture (e.g. televisions, mobile phones, cameras) also grew strongly.
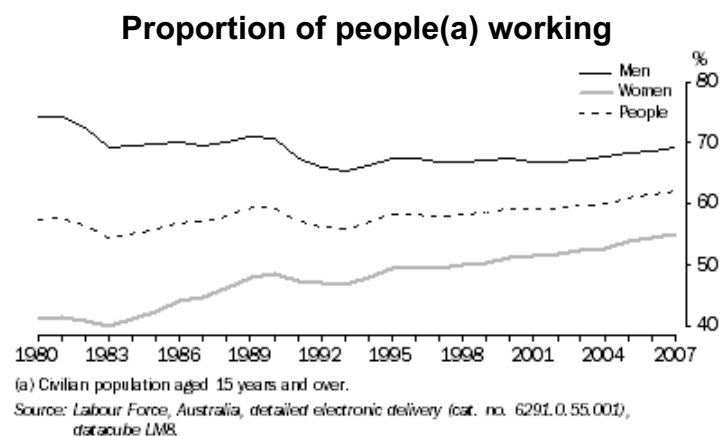
Changes in demand in turn affect people

Shifts in consumer demand can lead to changes in production and therefore changes to industry of employment. In addition, changes in processes and products within industries, often due to changed technology, lead to a shift in the type of jobs that employers offer. Such changes can have a positive effect

for the economy but can affect society when they lead to the loss of certain types of jobs (for example if manual jobs, once done by labourers, can be automated). The individual impact of this may be good (providing opportunities to learn different skills) or bad (leading to redundancy for those who aren't able to gain the necessary skills). In turn, changes in the skills needed by employees help to shape education and training programs.
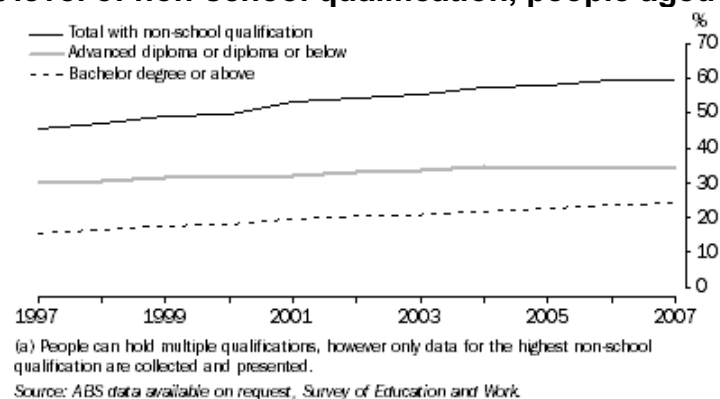
Labour supply and participation

People generate demand for goods and services, but they are also vital in meeting this demand. The larger the size of the labour force, the greater the number of people who are available to work and actively contribute to economic activity, facilitating higher levels of production. While the labour force may increase simply as a result of overall population growth, it may also grow because of increased labour force participation by certain groups within the population. The number of women working (as a proportion of all civilian women aged 15 years and over), an indicator used to help assess the work dimension of progress in MAP, has increased over time while the proportion of men working has declined. While there have been some fluctuations over the period, the net effect of these changes has been an increase in the proportion of people aged 15 years and over in employment, from 58% in 1980 to 62% in 2007. The age of the population also has impacts for labour force participation (and therefore economic growth), since nearly all Australians retire from work by age 65 years and some retire considerably younger.

Proportion of people(a) working

(a) Civilian population aged 15 years and over.

Source: Labour Force, Australia, detailed electronic delivery (cat. no. 6291.0.55.001), datacube LM8.
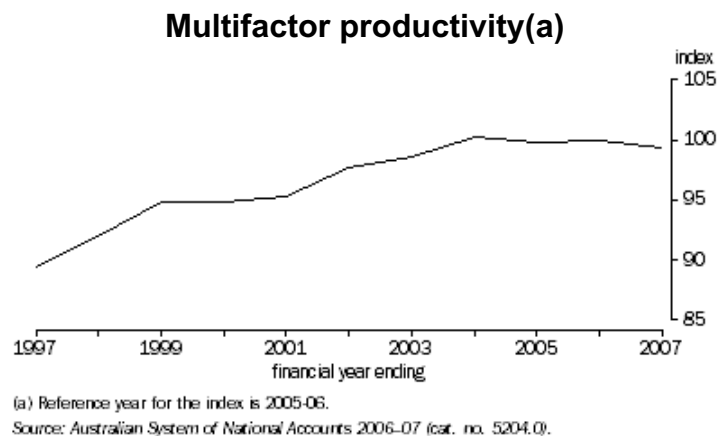
Human capital and productivity

Other societal factors also affect labour and therefore the economy. Key elements of human capital, along with hours worked, have the potential to enhance both productivity and participation in the labour force, thus strengthening the economy, illustrating a reinforcement relationship. The skills of the labour force, which may be enhanced by investment in people's education and training, can provide a more efficient/effective labour input to production, contributing to productivity. The headline indicator for education and training used in MAP is shown in the graph below. The proportion of 25-64 year olds with a non-school qualification has increased over the decade, from 46% in 1997 to 59% in 2007.

Highest level of non-school qualification, people aged 25-64(a)

(a) People can hold multiple qualifications, however only data for the highest non-school qualification are collected and presented.

Source: ABS data available on request, Survey of Education and Work.

Improved health also has the potential to allow more people to participate in the labour force, to help people perform better when at work, reduce the number of days people are absent from work and to allow people to remain in the workforce for longer. The Productivity Commission has estimated that enhancement of workforce participation and productivity through the stream of the National Reform Agenda that is directed at health promotion and disease prevention could potentially result in increases in GDP of around 6% after 25 or more years, although net gains would depend on the costs incurred in implementing programs (see endnote 2).

Increases in productivity are often attributed to improvements in the quality of labour or to innovation - people doing their jobs 'smarter'. The headline indicator for productivity used in MAP is 'multifactor productivity'. Multifactor productivity represents the improvements in productivity which occur when increases in goods and services (outputs) exceed what can be accounted for by increases in labour, capital or other inputs. From 1996-97 to 2006-07, multifactor productivity rose 1.1% per year on average.
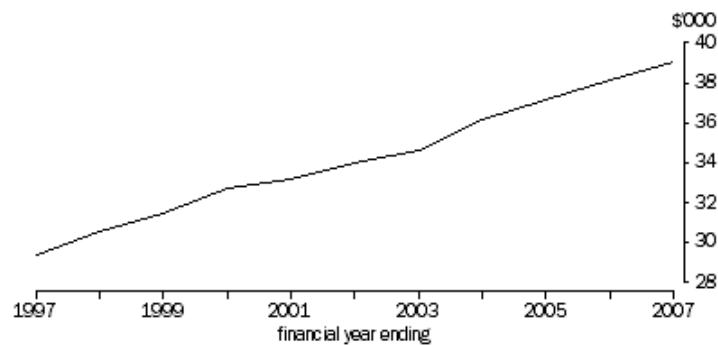
Multifactor productivity(a)

(a) Reference year for the index is 2005-06.

Source: Australian System of National Accounts 2006–07 (cat. no. 5204.0).

A strong economy reinforces the social domain

A strong economy can benefit society in a number of ways, including by increasing:

- real national income, which potentially improves material living standards for individuals either directly or indirectly through government provision of goods and services e.g. infrastructure such as roads, funding for health care and education.
- employment
- skills
- wages and/or quality of working conditions for some people as demand puts pressure on supply.

Real net national disposable income per person is the headline indicator for the national income dimension in MAP. This indicator and the other headline indicators for the economy, such as real national net worth per person and multifactor productivity, suggest some progress for the economy over the last decade. Between 1996-97 and 2006-07, real net national disposable income per person grew by 2.9% a year on average, while our net worth per person grew by 0.9% a year.
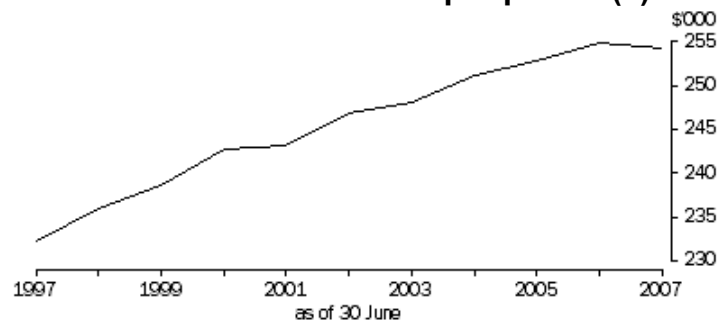
Real net national disposable income per person(a)

$000

40
38
36
34
32
30
28

1997   1999   2001   2003   2005   2007
financial year ending

(a) Reference year 2005–06.
Source: Australian System of National Accounts, 2006–07 (cat. no. 5204.0).

Real national net worth per person(a)

$000

255
250
245
240
235
230

1997   1999   2001   2003   2005   2007
as of 30 June

(a) Reference year 2005–06.
Source: Australian System of National Accounts, 2006–07 (cat. no. 5204.0);
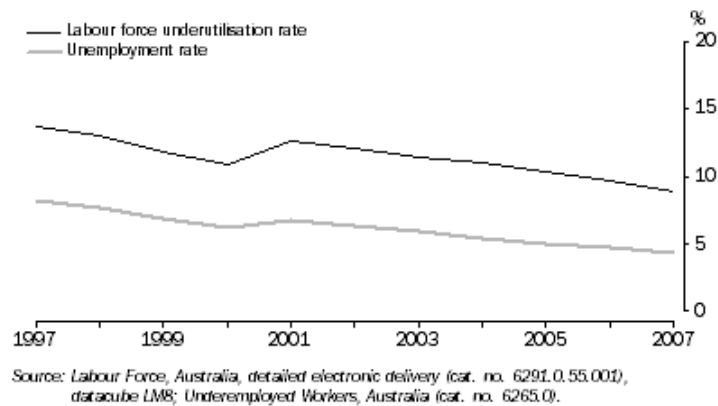Australian Demographic Statistics (cat. no. 3101.0).

The benefits education has for productivity affects individuals since people with higher skill levels and who are more productive tend to earn more. The income people earn by working has implications for other, inter-related, aspects of life that are important to wellbeing such as good health, engagement with wider social networks, good educational opportunities and outcomes, freedom from financial stress, and a decent and affordable place to live. In 2006, the level of social attachment, as measured by daily contact with family and friends, ability to ask for small favours, and ability to get support in a time of crisis, generally increased progressively across each income distribution quintile from lowest to highest. Some studies suggest that unemployment is associated with poorer health, increased crime and higher risks of financial hardship and lower levels of social cohesion (see endnote 3).

Trade-offs and negative links

While there are many benefits to increased economic activity, there may also be trade-offs. Such activity can lead to inflation and can have an adverse effect on housing affordability when rising incomes and employment drive up demand, and demand outpaces supply. While inflation is defined as a rise in the general level of prices, not all prices change by the same proportion (or even in the same direction). For this reason, inflation can affect the distribution of real income and wealth for individuals and households.

Just as economic upturns may have societal benefits (as well as costs), economic downturns are likely to have costs. Higher unemployment has social costs in terms of potential economic hardship for individuals and families, and economic costs, since many unemployed people need income support. Unemployment and the accompanying loss of income can also affect self-esteem for the individual and their family. In MAP, the headline indicators for the work dimension of progress are the unemployment rate and the labour force underutilisation rate (underemployment). Consistent with indicators of economic progress, unemployment and underemployment have fallen over the last decade.

Unemployment and labour force underutilisation rates

RELATIONSHIPS BETWEEN THE ECONOMY AND THE ENVIRONMENT

A framework was developed in 2003 to integrate economic and environmental accounts to show the role the environment plays in productive activity and the impact of economic activities on the physical environment, thus allowing the implications for sustainability of different patterns of production and consumption to be examined. The Handbook of National Accounting – Integrated Environmental and Economic Accounting 2003 (SEEA) allows for the development of environmental accounts. It outlines extensions to the System of National Accounts (because many transactions involving environmental goods and services are not economic in a national accounting sense, they are excluded from the scope of the System of National Accounts) to cover a wide range of environmental and natural resources, and allows investigation of the interactions between the economy and the environment. SEEA allows for valuation of environmental expenditures (to protect or mitigate damage to the environment, e.g. pollution control equipment), environmental services and the consumption of natural capital (e.g. mineral resources, forests).

Environmental inputs for the economy

The economy draws inputs from the environment in the form of natural resources such as land, minerals, fish and water. Agriculture is the major form of land use in Australia. In 2006, 57% of Australia was used for agricultural activity with most of the land used for grazing.

Water is an essential environmental resource upon which the economy draws. In 2004-05, almost 80,000 gigalitres of water was extracted from the environment and used within the Australian economy. Industries such as agriculture, manufacturing and mining have particularly intensive use of water. In the year ending June 2005, about 1% of the 256 surface water management areas which were assessed were 'overallocated' and a further 17% were developed to a 'high' level. About 5% of the 356 groundwater management units which were assessed were 'overallocated' and another 24% had a 'high' level of development (see endnote 4).
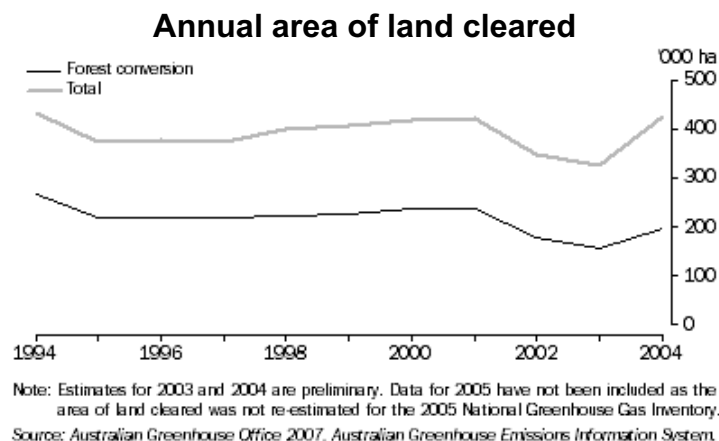
Industries are also dependent on the environment for the energy used in production. Most of the energy produced in Australia depends on the burning of fossil fuels, although some (about 8% in 2003) of the energy consumed comes from renewable sources such as wind, water (hydro electricity) or solar energy.

Trade-offs

Many of the relationships between the economy and the environment involve trade-offs. The economy's use of environmental inputs can threaten sustainability, with current environmental impacts and future economic impacts. Fishing is one example. One of the indicators used for the oceans and estuaries dimension in MAP is the number of fish species which are overfished. In 2006, for fish stocks managed by the Australian Government, 19 of the 97 principal species that are classified were overfished and/or subject to overfishing. This compares with 3 species (of 48 species classified) in 1996 (see endnote 5).

Land clearing, which is most often done for agricultural purposes (see endnote 6), destroys plants and removes the food and habitat on which native animals rely. Clearing allows weeds and invasive animals to spread, is a source of greenhouse gas emissions (since trees and other plants take up CO_2 from the atmosphere and carbon is released back into the atmosphere through burning or decay, see endnote 7) and can lead to soil degradation, such as erosion and salinity, which in turn can affect water quality. One of the headline indicators used in MAP is the annual area of land cleared. About 425,000 hectares of land were

cleared in 2004, 1% less than the 431,000 hectares cleared in 1994.

Annual area of land cleared

Note: Estimates for 2003 and 2004 are preliminary. Data for 2005 have not been included as the area of land cleared was not re-estimated for the 2005 National Greenhouse Gas Inventory.

Source: Australian Greenhouse Office 2007, Australian Greenhouse Emissions Information System.

Another headline indicator is greenhouse gas emissions. Australia's net greenhouse gas emissions in 2005 totalled 559 megatonnes (Mt) CO_2 equivalent, an increase of 2.2% since 1990. The energy sector was the largest source, contributing 70% of emissions, with agriculture the second largest emitter at 16%. The agriculture industry is the major source of both methane (accounting for 59.5% of methane produced in 2005) and nitrous oxide (85%) emissions. The sources of these emissions include: digestion of feed by livestock; the application of fertiliser, crop residues and animal wastes to land; and burning of grasslands and crop stubble (see endnote 8).

Reinforcements

While economic activity can have a negative impact on the environment, the fact that environmental resources are needed as an input to production acts as an economic driver to protect the environment. Investment in research and development can lead to technological innovations that result in more efficient production processes. Additionally, economic activity generates income streams to governments, which can be diverted into environmental programs and initiatives.

Decoupling

Despite the impetus for environmental protection, the natural environment may be traded off for economic progress. 'Decoupling' is the concept of breaking the link between the two, so that economic progress is achieved without harming the environment. Decoupling can also apply to the social and economic domains. It is included here to demonstrate how the need to make trade-offs (in this case, environmental trade-offs) can be lessened.

Decoupling can be measured by indicators that use an environmental pressure variable as the numerator and an economic variable as the denominator. For example, at the national level the growth rate of emissions of carbon dioxide can be compared with the growth of GDP. It is also possible to decompose such indicators to highlight the extent to which various factors, such as different technologies or structural changes, have contributed to environmental pressures. At a sectoral level the growth rate of emissions of carbon dioxide from electricity use, in the energy sector, for example, may be compared to the growth rate of total primary energy supply (see endnote 9). The OECD has developed a range of decoupling indicators: some relate to decoupling economic activity from climate change, air pollution, water quality, waste disposal, materials use and natural resources; while others focus on environmental pressures in sectors such as energy, transport, manufacturing and agriculture.

Decoupling may be 'absolute' or 'relative'. Absolute decoupling occurs when an environmental variable (e.g. carbon dioxide emissions) is either unchanged or falling while an economic variable to which it has been causally linked (e.g. GDP) has grown. Relative decoupling occurs when the variable of environmental pressure grows, but grows at a slower rate than the economic variable (see endnote 9).
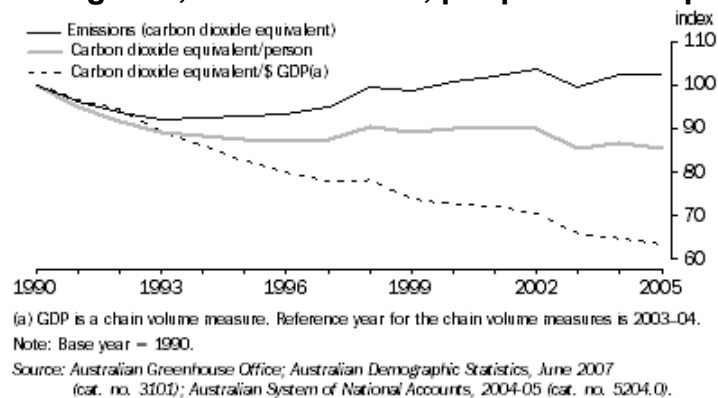
Analysis done by the OECD in 2002 suggested that, for most of the decoupling indicators for which there are Australian data available (about half of the indicators), some level of decoupling had occurred in Australia since the early 1980s. Most of this was relative decoupling (see endnote 9).

Examples of such decoupling indicators, for the economy and climate change, include total greenhouse gas emissions per unit of GDP and per person. These indicators are included in the air and atmosphere dimension of MAP. From 1990 to 2005 Australia's net greenhouse gas emissions (CO_2 equivalent) per person fell by 15% (see endnote 10). Nevertheless, Australia continues to have a relatively high level of per person emissions compared with other OECD countries (see endnote 11) as a result of:

- the dominance of the use of coal as a fuel in the electricity industry where, by contrast to many other OECD countries, there is no nuclear power produced and hydro-electric power options are limited
- net emissions from the land use, land use change and forestry sector (this sector accounts for changes in the amount of carbon biomass in vegetation and soil as a result of people's use of the land. It includes the effect of new forestry plantings as well as deforestation)
- the fact that many of the goods Australia produces for export - resource and agricultural products - have high associated emission levels (see endnote 8).

The length of time series available (the series for greenhouse gas emissions starts at 1990) does not allow an assessment of whether there have been changes in the relationships over a long period, in order to assess whether progress has been made. There may have been similar falls in emissions per person in the past.

Greenhouse gases, emissions: net, per person and per $ GDP

(a) GDP is a chain volume measure. Reference year for the chain volume measures is 2003-04.
Note: Base year = 1990.
Source: Australian Greenhouse Office; Australian Demographic Statistics, June 2007
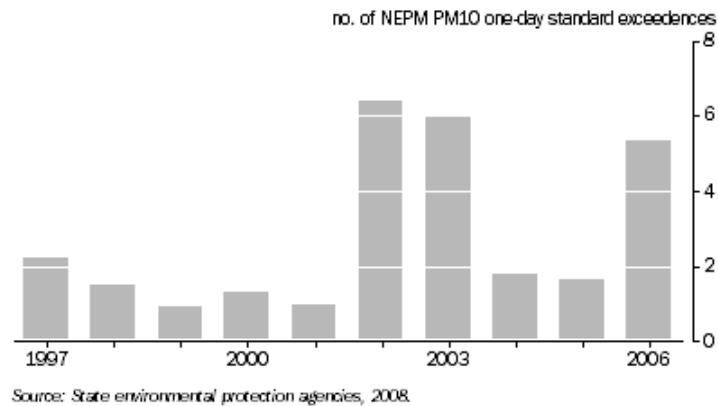(cat. no. 3101); Australian System of National Accounts, 2004-05 (cat. no. 5204.0).

RELATIONSHIPS BETWEEN THE ENVIRONMENT AND SOCIETY

The environment affects society

People rely on the environment. Products such as food, clean water and fuel are essential for people's health and comfort. Households consumed just over 2000 gigalitres of water in 2004-05 (down slightly from 2000-01 consumption), or 11% of total water consumption.

The environment affects people's health in a number of ways. One example is the health effects linked to ultraviolet exposure. Australia has high levels of UV radiation and the highest per person incidence of melanoma in the world. Another example is air quality. Poor air quality can cause health problems. The headline indicator used for air and atmosphere in MAP considers the concentration of fine particles in the atmosphere, a measure of the form of air pollution about which many health experts in Australia are most concerned. Overall, air quality in Australia is relatively good, although the impact of bushfires and dust storms can be seen in recent years.
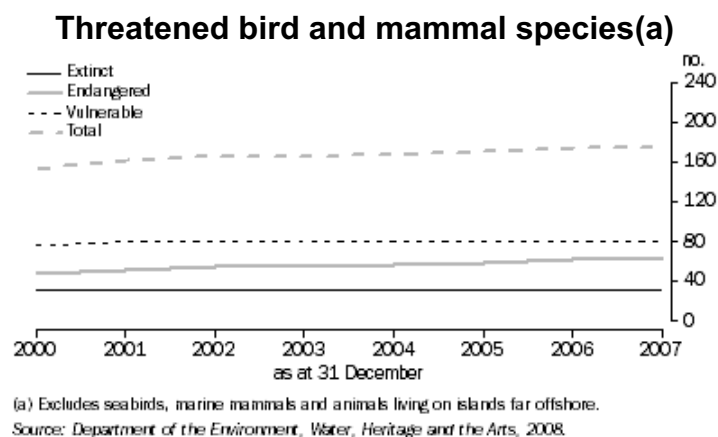
Days fine particle health standards were exceeded

no. of NEPM PM10 one-day standard exceedences

Source: State environmental protection agencies, 2008.

In addition to the products and services the environment provides, the environment has intrinsic value. In considering the value of conservation of the world's natural resources, most frameworks allude to the enjoyment people gain from recreational activities, but also recognise that some people may gain satisfaction simply from knowing that the natural environment exists (even if they never experience parts of it themselves). Many cultures, including those of Australia's Indigenous peoples, have strong spiritual links to the land and its wildlife.

Trade-offs and reinforcements

People affect the environment in both positive and negative ways by the things they do. The value people place on the environment has led to laws being passed to protect endangered species. However, consideration for the conservation of the natural environment can involve trade-offs in relation to lifestyles and use of resources which people are not always willing to make. One of the headline indicators presented in MAP is the number of threatened bird and mammal species. Between 2000 and 2007 the number of terrestrial bird and mammal species assessed as extinct, endangered or vulnerable rose from 153 to 174, an increase of 14%. While some change in biodiversity might be expected due to other causes, loss of native vegetation due to human activity such as land clearing has been identified as a key threat to Australia's biodiversity (see endnote 12).

Threatened bird and mammal species(a)

(a) Excludes seabirds, marine mammals and animals living on islands far offshore.
Source: Department of the Environment, Water, Heritage and the Arts, 2008.

In addition to the regulatory and legal frameworks governing environment protection, increased environmental awareness has led to people adopting measures to reduce our impact on the environment, such as recycling household waste (99% of households recycled products in March 2006, up from 85% in May 1992). Australians are also concerned about the conservation of water resources. As a response to drought conditions and consequent water use restrictions, many Australian households have used measures to conserve water in recent years. In 2007, the majority of Australian households had some type of water conservation device installed in their home.

People are also responsible for negative consequences for the environment. Population growth and urban expansion, particularly in coastal areas and capital cities, are placing increased pressure on the environment in those locations (see endnote 12). An example of a trade-off between society and the environment is when people contribute to increased greenhouse gas emissions through consumption of

goods and services, such as household appliances and use of motor vehicles. The rise in greenhouse gas emissions over the period 1990 to 2005 was primarily driven by a rise of 43% (83.4 Mt CO_2-e) in emissions from the stationary energy sector. Of the activities covered by the stationary energy sector, electricity production has by far the largest overall impact on the environment. The 43% rise in emissions was driven in part by increasing population and household incomes (leading to higher demand for goods and services). Transport was the next largest growth sector with an increase of 30% (18.5 Mt CO_2-e). Road transport was the main source of transport emissions in 2005 (88%) and passenger cars were the largest transport source (see endnote 8).

CONCLUSION

The headline indicators presented in MAP suggest some progress in the economic and social domains over the last decade. This article has illustrated some of the associated reinforcement between economic and social progress. While the environmental domain is more difficult to measure comprehensively, some of the headline indicators suggest that economic and social progress has come partly at the cost of negative environmental impacts. Nevertheless, there is some evidence of relative decoupling in recent years that has reduced the trade-off between economic growth and environmental degradation. Sustainability is important in this context, and international initiatives to develop indicators of sustainability currently underway may help inform the presentation of MAP indicators in the future.

ENDNOTES

1. Organisation for Economic Co-operation and Development 2005, Glossary of Statistical Terms, Paris.

2. Productivity Commission 2006, Potential Benefits of the National Reform Agenda, Report to the Council of Australian Governments, Canberra.

3. Borland, J. and Kennedy, S. 1998 'Dimensions, Structure and History of Australian Unemployment', in Borland, J. and Debelle, G. (eds), Unemployment and the Australian Labour Market, Proceedings of a Conference, Reserve Bank of Australia and Australian National University, Canberra.

4. The data are sourced from the National Water Commission, Australian Water Resources 2005. A water source with a high level of development is one where the sum of water access entitlements is between 70% and 100% of sustainable yield. An overallocated water source is one where the sum of water access entitlements is more than 100% of sustainable yield.

5. Larcombe, J. and McLoughlin, K. (eds) 2007 Fishery Status Reports 2006: Status of Fish Stocks Managed by the Australian Government. Bureau of Rural Sciences, Canberra.

6. Australian Greenhouse Office (AGO) 2000, Land clearing: a social history, National Carbon Accounting System Technical Report No. 4, Canberra.

7. Australian Government Department of Climate Change, Forest sinks, viewed 24/01/2008.

8. AGO 2007, National Greenhouse Gas Inventory 2005, Canberra.

9. Organisation for Economic Co-operation and Development (OECD) 2002, Indicators to Measure Decoupling of Environmental Pressure from Economic Growth, OECD, Paris.

10. The data differ slightly from those published in 2007 Australian Greenhouse Office (AGO) publications. This article uses the most recent figures for the greenhouse office emissions and estimated resident population as available in January 2008. As these series are revised over time, the figures will vary according to the timing of publication releases. This article also uses estimated resident population as at June each year while the AGO uses December as its reference point.

11. ABS, 2007, Australia's Environment: Issues and Trends, 2007 (4613.0), Canberra.

12. Beeton RJS (Bob), Buckley Kristal I, Jones Gary J, Morgan Denise, Reichelt Russell E, Trewin Dennis (2006 Australian State of the Environment Committee), 2006, State of the Environment 2006.

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